Bigelow Expandable Activity Module Project (BEAM)

Completed Technology Project (2013 - 2020)

Project Introduction

The Bigelow Expandable Activity Module (BEAM) project is a NASA-industry partnership with Bigelow Aerospace (BA) that developed the first human-rated expandable (also called "inflatable") space habitat for demonstration on the International Space Station (ISS). The partnership offers NASA substantial cost savings for technology development and for future exploration missions that could use commercially-provided expandable structures and habitats.

The BEAM project advances expandable habitat technology by conducting a flight demonstration of a commercially-designed expandable system to achieve Technology Readiness Level 9.0. The primary performance requirement is to demonstrate that the BEAM can successfully launch and berth to the ISS, deploy and expand, and maintain long-term pressure without leakage. The leak performance is defined as both short-term, immediately after deployment, and long-term, for the balance of the mission.

BEAM was successfully launched on SpaceX CRS-8 (April 8, 2016), berthed to ISS Node 3 Aft and pressurized on May 28 2016. BEAM successfully completed leak testing and the first crew ingress was June 6, 2016. BEAM, originally certified for a two-year life, has been functioning as expected and in November 2018 NASA and Bigelow Aerospace authorized BEAM for utilization as a stowage module and extended the mission life to the end-of-ISS life.

The demonstration consists of the following critical technology objectives:

- Launch of a packed expandable structure in a Commercial Resupply Services (CRS) launch vehicle
- Safe deployment (expansion) on ISS
- Passive air exchange with ISS and an environment inside the BEAM supporting periodic, temporary ingress by the ISS crew
- Measure deployment loads during expansion of the BEAM on ISS
- Determine radiation protection capability of an expandable structure in low-Earth orbit and demonstrate the performance of advanced active radiation sensors on ISS
- Long-term structural performance of expandable shell after exposure to atomic oxygen, vacuum, radiation, and thermal cycling
- Demonstrate performance of structural health monitoring systems
- Measure long-term leak performance of expandable bladder and bladder joints after launch and deployment cycle
- Develop structural and mechanical system requirements for a human-rated expandable module in an external orbital environment and successfully verify those requirements.
- Develop crew restraints and mobility aids for Intravehicular Activity (IVA) inside an expandable module.
- Develop and implement "housekeeping" procedures for internal surfaces of an expandable module.

-Demonstrate utilization as a stowage module.

BEAM om ISS Node 3 Aft

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For more information, see the following links below:

BEAM Advanced Exploration Systems (AES) Project Overview

https://www.nasa.gov/content/bigelow-expandable-activity-module

NASA Extends BEAM's Time on the International Space Station

https://www.nasa.gov/feature/nasa-extends-beam-s-time-on-the-international-space-station

BEAM First Year On-Orbit (May 26, 2017)

https://www.nasa.gov/feature/first-year-of-beam-demo-offers-valuable-data-on-expandable-habitats

BEAM Stowage Utilization and Life Extension (October 2, 2017)

https://www.nasa.gov/feature/nasa-may-extend-beam-s-time-on-the-international-space-station

BEAM Facts, Figures, FAQs (July 17, 2017)

https://www.nasa.gov/feature/beam-facts-figures-faqs

BEAM Overview (March 12, 2015)

https://www.nasa.gov/content/new-expandable-addition-on-space-station-to-gather-critical-data-for-future-space-habitat

The BEAM Project was transferred to the ISS Program October 2020.

Organizational Responsibility

Responsible Mission Directorate:

Exploration Systems Development Mission Directorate (ESDMD)

Lead Center / Facility:

Johnson Space Center (JSC)

Responsible Program:

Exploration Capabilities

Project Management

Program Director:

Christopher L Moore

Project Manager:

Gerard D Valle

Principal Investigator:

Gerard D Valle

Co-Investigators:

Nathan D Wells
John V Iovine
Dan J Fry
Michael S Grygier

Anticipated Benefits

The NASA-Bigelow partnership enables both partners to learn how to develop, launch, install, and test expandable structures, all at substantial cost savings relative to either party doing these things alone. The BEAM project develops structural and mechanical system requirements for a human-rated expandable

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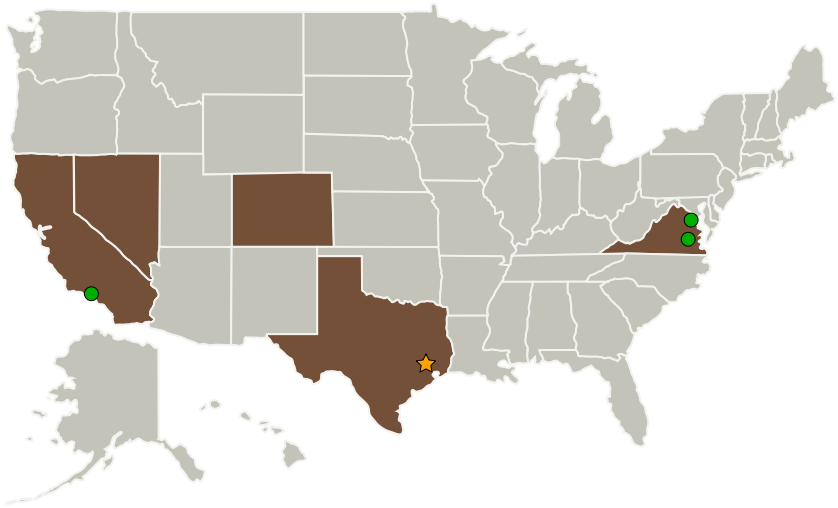
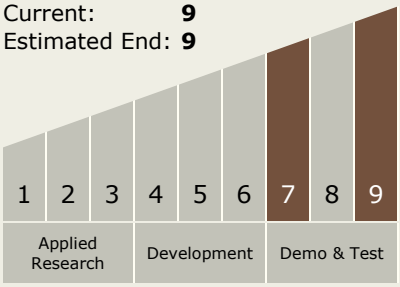
module in an external orbital environment and verifies those requirements. After BEAM installation on the ISS, NASA will gain valuable insight into the performance of an expandable module in orbit.

Primary U.S. Work Locations and Key Partners



Technology Maturity (TRL)

Start: **7**
Current: **9**
Estimated End: **9**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing

Other/Cross-cutting:

- TX06 Human Health, Life Support, and Habitation Systems
- TX07 Exploration Destination Systems

Target Destinations

The Moon, Mars, Others Inside the Solar System

Supported Mission Type

Projected Mission (Pull)

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Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
ATA Engineering, Inc.	Supporting Organization	Industry	San Diego, California
Bigelow Aerospace(BA)	Supporting Organization	Industry	
Jacobs Engineering Group, Inc.	Supporting Organization	Industry	Dallas, Texas
●Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California
●Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia
●NASA Headquarters(HQ)	Supporting Organization	NASA Center	Washington, District of Columbia
Sierra Nevada Corporation(SNC)	Supporting Organization	Industry Women-Owned Small Business (WOSB)	Sparks, Nevada
SpaceX	Supporting Organization	Industry	
The Boeing Company(Boeing)	Supporting Organization	Industry	Chicago, Illinois
Wyle Laboratories, Inc.	Supporting Organization	Industry	

Co-Funding Partners	Type	Location
TASI Group	Industry	Marlborough, Outside the United States, Morocco

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Primary U.S. Work Locations	
California	Colorado
District of Columbia	Nevada
Texas	Virginia

Project Transitions

January 2013: Project Start

September 2020: Closed out

Closeout Summary: The BEAM Project was transferred to the ISS Program October 2020. Closeout summary is same as C loseout document (pdf).

Images

BEAM
Inside View of BEAM Module Mockup
(https://techport.nasa.gov/image/41147)

BEAM Mockup
Bigelow Expandable Activity Module (BEAM) Mockup
(https://techport.nasa.gov/image/41146)

BEAM on ISS
BEAM om ISS Node 3 Aft
(https://techport.nasa.gov/image/41152)

Expedition 47 Crew inside of BEAM
Expedition 47 Crew inside of BEAM
(https://techport.nasa.gov/image/41153)

Stories

Success Story AES BEAM 2015-08-28
(https://techport.nasa.gov/file/62855)

Links

NASA Extends BEAM's Time on ISS
(https://www.nasa.gov/feature/nasa-extends-beam-s-time-on-the-international-space-station)

Project Website:

https://www.nasa.gov/content/bigelow-expandable-activity-module